Mevlana International Journal of Education (MIJE)
Vol. 4(1), pp. 55-66, 1 April, 2014
Available online at http://mije.mevlana.edu.tr/
http://dx.doi.org/10.13054/mije.13.55.4.1

An Investigation of Science Active Learning Strategy Use in Relation to Motivational Beliefs

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Article history
Received:
29.07.2013

Received in revised form:
02.01.2014

Accepted:
07.01.2014

Key words:
Active learning strategy; self-efficacy; science learning value; goal orientations; science

The present study investigated middle school students' science active learning strategy use in relation to motivational beliefs of self-efficacy, science learning value, personal goal orientations, and perceived parent goal emphasize. Totally 458 Grade 6-8 students participated in the study. Hierarchical regression analyses revealed that perceptions of parent mastery goal emphasize, personal mastery goal orientation, self-efficacy, and value beliefs were significant predictors of active learning strategies. Accordingly, students who perceived higher levels of parent mastery goal emphasize, who engaged in science tasks with the purpose of improving understanding, who were confident about their abilities to perform well in science activities, and who believed the importance and utility of the science task used higher levels of active learning strategies. Some suggestions were made to science teachers in order to form science learning environments which support students' motivational beliefs and active learning strategies such as emphasizing the importance of learning the material and improving skills; showing students that ability can be improved through effort; and holding discussions about utility of the science task. Parents were also suggested to promote their children's mastery goals by highlighting the importance of meaningful learning rather than just memorizing, encouraging their children to do challenging problems and work hard.

Introduction

The importance of learning strategies for enhancing students' learning has been addressed in several research studies (e.g., Pintrich & De Groot, 1990; Pintrich, 2002). Some studies made distinction among cognitive, metacognitive, and resource management strategies (e.g., Pintrich, 1999); superficial, deep cognitive, and metacognitive learning strategies (e.g., Young, 2005); active and superficial learning strategies (e.g., Meece & Miller, 2001). Cognitive strategies refers to rehearsal (i.e., recitation of items), elaboration (i.e., making associations between new information and existing knowledge), and organizational strategies (i.e., formation of groups and hierarchies) (Weinstein & Mayer, 1986). Elaboration and organization are deeper processing strategies than rehearsal which is a superficial strategy (Weinstein & Mayer, 1986; Young, 2005). Regulation of cognition is related to metacognitive strategies (Pintrich, 1999). For instance, skimming the text before reading, asking questions about the text to check understanding, rereading the portion of the text that has not been

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understood are examples of planning, monitoring, and regulation types of metacognitive strategies, respectively (Pintrich, 1999). Strategies related to management and controlling of the learning environment such as managing time are referred as resource management strategies (Zimmerman & Martinez-Pons, 1986).

Some other researchers utilized more general learning strategies that can be applied to various contexts (e.g., Ames & Archer, 1988; Young, 1997). For instance, Ames and Archer (1988) investigated students' use of strategies in the process of learning and studying in order to regulate and monitor effort and comprehension such as self-planning and self-monitoring. More recently, Tuan, Chin, and Shieh (2005) conceptualized active learning strategies in science from a constructivist view point. They defined active learning strategy as "Students take an active role in using a variety of strategies to construct new knowledge based on their previous understanding" (p. 643). Constructivism emphasizes individual experiences in construction of knowledge (von Glasersfeld, 1991). Accordingly, students have an active role in their own learning; they integrate new information into their existing knowledge (Loyens & Gijbels, 2008). In order to support students' construction of their own understanding, use of authentic learning tasks and real-life problems are recommended (Herrington & Oliver, 2000). Turkey has revised its science curriculum in order to support constructivist learning (Ministry of National Education, 2004). Therefore, in the present study, Tuan et al.'s (2005) conceptualization of learning strategy which approaches science learning from constructivist view point was followed.

Despite the importance of learning strategies, individual need to *motivate* oneself in order to use these strategies (Zimmerman, 2005). In fact, motivational variables have been linked to various student outcomes such as cognitive engagement (e.g., Garcia & Pintrich, 1993), conceptual change (e.g., Pintrich, Marx, & Boyle, 1993), and learning strategies (e.g., Midgley, Arunkumar, & Urdan, 1996). In order to understand students' use of different strategies, literature points motivational components to be explored in research studies (e.g., Pintrich & De Groot, 1990; Meece, Blumenfeld, & Hoyle, 1988). Pintrich (1999) identified *self-efficacy*, *task value*, and *goal orientations* as important motivational beliefs in students' learning. Although these constructs have been investigated in various studies conducted in Westernized nations, there is limited research from eastern countries (e.g., Kahraman & Sungur, 2011; Sungur, 2007). Theories of motivation and learning are mostly developed in western cultures and they incorporate values and belief systems of the context (McInerney, 2008). Therefore, there is need to examine underlying relationships in different cultural contexts (Maehr & Meyer, 1997). In the present study, predictive effect of perceived parent goal orientations, personal goal orientations, science learning value, and self-efficacy on students' active learning strategy use will be examined among Turkish elementary school students.

Self-efficacy beliefs

Self-efficacy is defined as "people's judgments of their capabilities to organize and execute courses of action required to attain designed types of performances" (Bandura, 1986, p.391). According to social cognitive theory, individuals' beliefs about their capabilities to perform a given task influence their choice behavior. What courses of action to follow, how much effort to expend, and how long to persist on given activity are partially determined by self-efficacy beliefs. For instance, in the face of the obstacles individuals with high self-efficacy are likely to exert greater effort to accomplish while individuals with low self-efficacy tend to invest less effort of give up the task (Bandura, 1986). Self-efficacy beliefs influence individuals' motivation, cognition, and behavior (Bandura, 1986; 1993). Studies

have demonstrated that students who feel more self-efficacious use more cognitive, metacognitive, and self-regulated strategies, pursue more mastery goals and less performance-avoidance goals, and demonstrate higher levels of achievement (e.g., Anderman & Young, 1994; Kahraman & Sungur, 2011; Middleton & Midgley, 1997; Pintrich, 1999; Pintrich & De Groot, 1990; Wolters, Yu & Pintrich, 1996; Zimmerman & Martinez-Pons, 1990).

Value beliefs

Value is another motivational factor which is related to students' self-regulated learning (Pintrich, 1999). Expectancy-value theory of motivation proposes that individuals' expectations about how well they will perform the activity and value of the activity for them are important in explaining individuals' choice and performance (Wigfield & Eccles, 2000). The importance of the task for the individual (i.e., attainment value), the enjoyment due to engaging in the tasks (i.e., intrinsic value), the usefulness of the task (i.e., utility value), and the negative cost due to the task (i.e., cost) operates together and forms the value of the task for the individual (Eccles et al., 1983, as cited in Wigfield & Eccles, 2000). Task value has been associated with strategy use and achievement in different studies (e.g., Pintrich & De Groot, 1990; Sungur, 2007; Yumusak, Sungur, & Çakıroğlu, 2007).

Goal orientations

Achievement goal theory (Ames, 1992; Dweck, 1986; Nicholls, 1984) is related to individuals' reasons for engaging in achievement behavior. For *mastery goal oriented* individuals, it is important to improve their abilities and enhance understanding. *Performance-approach goal oriented* individuals on the other hand are concerned with demonstrating their abilities and showing their competence to others. *Performance-avoidance goal oriented* individuals are concerned with avoiding looking incompetent. While mastery goal oriented individuals evaluate their performance based on self-referenced standards, performance oriented individuals use normatively-based standards (Pintrich, 2000a). Studies generally demonstrated that mastery goal orientation is associated with adaptive patterns of behavior, such as higher levels of self-efficacy, cognitive engagement, and self-regulated learning. On the other hand, performance-avoidance goal orientation was found to be associated with lower levels of cognitive engagement and self-efficacy (Anderman & Maehr, 1994; Elliot & Harackiewicz, 1996; Kaplan, Gheen, & Midgley, 2002; Kahraman, 2011; Maehr & Midgley, 1991; Middleton & Midgley, 1997). The associations yielded in the studies about performance-approach goal orientation revealed mixed results (Shih, 2005). Some studies found performance-approach goals to be related with adaptive student outcomes, with maladaptive student outcomes, while others revealed null relationships (Kaplan et al., 2002). Besides personal goal orientations, students' perceptions of their parents' goal emphasis have been focus of research (e.g., Friedel, Cortina, Turner, & Midgley, 2007).

Learning strategy use in relation to self-efficacy, task value, and goal orientations

Several studies have investigated the relationships between learning strategies and motivational factors of self-efficacy and task value beliefs, and goal orientations. For instance, in a correlational study with seventh grade students' (n= 173), it was found that students who believed that they were capable of performing academic tasks (high in self-efficacy) and who believed that tasks were important and interesting (high in value) were more likely to use more cognitive strategies (i.e., rehearsal, elaboration, organization) and self-regulatory strategies (i.e., metacognitive and effort management strategies) than students

low in self-efficacy and value (Pintrich & De Groot, 1990). In a study from Turkey, seventh grade students (*n*= 115) were surveyed in order to explore students' use of metacognitive strategies such as such as planning, monitoring, and evaluating. Regression analysis revealed that self-efficacy significantly and positively predicted students' metacognitive strategies (Kahraman & Sungur, 2011). Sungur (2007) examined the relationships between motivational beliefs and meatcognitive strategy use in a group of high school students (*n*= 391). Path analyses results showed that task value beliefs (β= .16), self-efficacy (β= .15), and control of learning beliefs (β= .10) were significantly related to metacognitive strategy use.

Goal orientations have been linked to various strategies in different studies (e.g., Pintrich, 2000b; Midgley & Urdan, 2001). Generally it was found that mastery goal orientation was positively related to cognitive, metacognitive, and self-regulated strategies (e.g., Kahraman & Sungur, 2011; Pintrich, 1999; Pintrich, 2000b; Wolters, 2004) while performance-approach and performance-avoidance goal orientations were unrelated to cognitive and metacognitive strategies (e.g., Kahraman & Sungur, 2011; Wolters, 2004). For instance, studying with junior high school students (*n*= 525), Wolters (2004) found that orientation towards mastery goals significantly and positively predicted cognitive and metacognitive strategy use whereas performance-approach and performance-avoidance goal orientations were not related to use of cognitive and metacognitive strategies. Friedel et al. (2007) examined the relationships among goal orientations, efficacy beliefs, and coping strategies in mathematics among seventh grade students (*n*= 1021). Structural equation modeling analyses results revealed that perceived parent goal emphasis predicted students' personal goal orientations. Furthermore, personal goal orientations mediated the relationships between perceived parent goal emphasis and self-efficacy and coping strategies.

Method

This study was a quantitative study due to the nature of research questions addressed, data collection procedure followed, and statistical analyses utilized: The research questions mainly addressed relationships among motivational variables and active learning strategy use; the data were collected through self-report instruments; and hierarchical regression analyses were conducted to investigate the predictive effect of motivational beliefs on active learning strategy use.

Participants

A total of 483 students attending three public middle schools (labeled school A, B, and C) in one of the largest cities in Turkey participated in the study. There were 156 sixth grade (32.3%), 179 seventh grade (37.1%), and 148 eight grade (30.6%) students. Of the participants, 220 (45.5%) were girls and 263 (54.5%) were boys.

Multiple indicators are used to assess students' socio economic status such as education level of parents, presence of a separate study room at home, and possession of an internet connected computer at home (Akyol, 2009; Sirin, 2005). In our sample, education level of the parents in school A was lower than in school B and C. In school A, 18.5% of the mothers had never gone to school and 66.9% of the mothers were graduated from primary school. In school B and C, 1.1% of the mothers had no schooling and 27.0% were primary school graduates. In school A, only 4.8% of the mothers were graduated from high school or university while in school B and C the rate was 53.2%. Education levels of fathers were also similar to mothers. Half of the students in school A (50.8%) had a study room at home, while the rate was 87.2% in school B and C. The rate of students who had a computer at home was

57.3% in school A, while it was 91.6% in school B and C. Therefore, school A was considered having low socio economic status while the other two schools (labeled as school B and C) had medium socio economic status.

Instruments

Items of the scales used in the present study were taken from Students' Motivation towards Science Learning Questionnaire (SMTSL; Tuan et al., 2005), Patterns of Adaptive Learning Scales (PALS; Midgley et al., 2000), and perceived parent goal emphases (Friedel et al., 2007). All items were scored on a 5 point Likert scale from 1 "strongly disagree" to 5 "strongly agree".

Items of the *self-efficacy* (e.g. "Whether the science content is difficult or easy, I am sure that I can understand it.", *n*= 6 items), *active learning strategies* (e.g. "When learning new science concepts, I connect them to my previous experiences.", *n*= 8 items), and *science learning value* (e.g. "I think that learning science is important because I can use it in my daily life.", *n*= 5 items) were taken from the SMTSL (Tuan et al., 2005). The SMTSL was translated and adapted into Turkish by Baser (2007).

Personal achievement goal orientations were taken from PALS (Midgley et al., 2000). Personal achievement goal orientations are *mastery goal orientation* (e.g., "It's important to me that I thoroughly understand my class work", *n*= 5 items), *performance-approach goal orientation* (e.g., "One of my goals is to show others that I'm good at my class work", "One of my goals is to look smart in comparison to the other students in my class", *n*= 5 items), and *performance-avoidance goal orientation* (e.g., "One of my goals in class is to avoid looking like I have trouble doing the work", *n*= 4 items). The scale was adapted and translated into Turkish by Taş (2008).

Perceived parent goal emphases were utilized from Friedel et al. (2007). Perceived parent goal emphases were *perceived parent mastery goal emphasis* (e.g., "My parents want me to understand math concepts, not just do the work", *n*= 6 items) and *perceived parent performance goal emphasis* (e.g., "My parents would like it if I could show that I'm better at math than other students in my class", *n*= 5 items). The scale was adapted and translated into Turkish by Kahraman (2011).

In the present study, Confirmatory Factor Analysis was conducted using LISREL 8.30 (Joreskog & Sorbom, 1999) in order to test the factor structure. Fit indices supported the proposed factor structure well (Comparative Fit Index [CFI] = .974, Normed Fit Index [NFI] = .949, Standardized Root Mean Square Residuals [SRMR] = .052, Root Mean Square Error of Approximation [RMSEA] = .048 with 90% confidence interval of .045 and .050). Descriptive statistics for and Cronbach alpha reliability coefficients of the subscales are displayed in Table 1.

Table 1. Descriptive statistics.

Subscale	*M*	*SD*	Skewness	Kurtosis	Cronbach Alpha
Mastery goal orientation	4.18	.83	-1.32	1.76	.87
Performance-approach goal orientation	3.71	1.03	-.70	-.15	.86
Performance-avoidance goal orientation	3.94	1.00	-.96	.38	.77
Self-efficacy	3.83	.82	-.54	-.29	.77
Science learning value	3.98	.85	-.85	.31	.83
Active learning strategies	3.90	.79	-.79	.51	.87
Perceived parent mastery goal emphasis	3.80	.77	-.646	.58	.75
Perceived parent performance goal emphasis	3.65	.87	-.60	.06	.69

Results

Descriptive statistics for the variables of the study are presented in Table 1. Mean values for personal goal orientations were high: Students were highly concerned with developing their understanding and improving skills (mastery goal orientation). Student also involved in the learning activities with the purpose of avoiding demonstration of lack of competence (performance-avoidance goal orientation). Students were to a lesser extent concerned with demonstration of their abilities relative to others (performance-approach goal orientation). Furthermore, students' beliefs in their abilities to accomplish science tasks and their science learning value were high. They reported to use various learning strategies, as well. Students perceived their parents as emphasizing more mastery goals, such as learning from mistakes than emphasizing performance goals, such as striving to outperform others.

In order to examine whether (a) student gender and socio economic status, (b) perceived parent goal emphasis, (c) students' personal goal orientations, and (d) their motivational beliefs predict students' active learning strategies a hierarchical multiple regression was conducted. Regression coefficients are presented in Table 2. In the first step, gender and socio economic status were entered. Both predictors emerged as significantly related to the outcome variable; girls and students with medium socio economic status reported to use more active learning strategies than boys and students with low socio economic status. In the second step, perceived parent mastery goal emphasis (β= .42, p< .001) and perceived parent performance goal emphasis (β= .10, p< .05) were entered which were significantly and positively related to the outcome variable. They explained an additional 20% of the variance in active learning strategies. In the third step, students' personal goal orientations were entered and together they explained an additional 33% of the variance in active learning strategies. When controlling for the other predictors in the model, pursuing mastery goals (β= .62, p< .001) statistically significantly and positively predicted active learning strategies whereas performance-approach and performance-avoidance goal orientations were unrelated to active learning strategies. In the last step, motivational beliefs variables of self-efficacy and science learning value were added to the model. Controlling for the other variables in the model, self-efficacy (β= .23, p< .001) and science learning value (β= .24, p< .001) both statistically significantly and positively predicted active learning strategies, and together they explained an additional 8% of the variance in active learning strategies. In the final model, perceived parent mastery goals, personal mastery goal orientation, self-efficacy, and science learning

value were significant predictors of active learning strategies. The R^2 change was statistically significant for each step indicating improvement of the model at each stage of the analysis. The final model accounted for 66.6% of the variance in students' active learning strategy use.

Table 2. Hierarchical multiple regression analysis predicting active learning strategies.

	B	*SE* B	*β*
Step 1			
Constant	3.51	0.08	
Gender	0.20	0.07	.13**
Socio economic status	0.40	0.08	.22***
Step 2			
Constant	1.75	0.18	
Gender	0.16	0.06	.10*
Socio economic status	0.17	0.07	.09*
Perceived parent mastery goal emphasis	0.43	0.05	.42***
Perceived parent performance goal emphasis	0.09	0.04	.10*
Step 3			
Constant	0.48	0.15	
Gender	0.08	0.05	.05
Socio economic status	0.14	0.06	.08*
Perceived parent mastery goal emphasis	0.20	0.04	.20***
Perceived parent performance goal emphasis	-0.04	0.03	-.05
Mastery goal orientation	0.59	0.03	.62***
Performance-approach goal orientation	0.05	0.03	.07
Performance-avoidance goal orientation	0.01	.03	.01
Step 4			
Constant	0.12	0.14	
Gender	0.07	0.04	.04
Socio economic status	0.07	0.05	.04
Perceived parent mastery goal emphasis	0.14	0.03	.14***
Perceived parent performance goal emphasis	-0.02	0.03	-.02
Mastery goal orientation	0.33	0.04	.35***
Performance-approach goal orientation	0.02	0.03	.03
Performance-avoidance goal orientation	0.00	0.03	.00
Science learning value	0.22	0.04	.24***
Self-efficacy	0.22	0.03	.23***

Note: R^2 = .06 for Step 1; ΔR^2 = .20 for Step 2 (p< .001); ΔR^2 = .33 for Step 3 (p< .001); ΔR^2 = .08 for Step 4 (p< .001).
*p< .05, **p< .01, ***p< .001.
Gender coded 0= Boy, 1= Girl.
Socio economic status coded 0= low socio economic status, 1= medium socio economic status

Discussion and Conclusion

The present study aimed to investigate Turkish elementary school students' active learning strategy use in relation to motivational constructs (perceived parent goal orientations, personal goal orientations, science learning value, and self-efficacy). Hierarchical multiple regression analyses revealed that girls and students with medium socio economic status used higher levels of active learning strategies than boys and students with low socio economic

status. Controlling for student gender and socio economic status, perceived parent goal emphases positively predicted students' use of active learning strategies. Among the personal goal orientations, only mastery goal orientation was a significant predictor of the outcome variable. In the last step of the hierarchy, self-efficacy and science learning value were added to the model. Perceived parent mastery goal orientation, personal mastery goal orientation, science learning value, and self-efficacy emerged as significant predictors of active learning strategies.

It was found that perceived parent mastery goal orientation was a significant and positive predictor of students' use of active learning strategies. This finding is in line with Friedel et al. (2007) which revealed that students' perceived parent mastery goal emphasis was positively correlated with personal mastery goal orientations, self-efficacy, and positive coping strategies. If students interpret their interaction with parent as emphasizing mastery goals, they were more likely to use active learning strategies. Therefore, it seems important that parents may highlight the importance of meaningful learning rather than just memorizing, encourage their children to do challenging problems and work hard, and emphasize that understanding is important rather than grades. Personal mastery goal orientation also positively and significantly predicted students' use of active learning strategies. In other words, students who were concerned with improving their competence and developing their skills were more likely to use active learning strategies. This finding was expected because individuals who pursue mastery goals value learning itself and in order to enhance their understanding, they tend to work hard and prefer challenging tasks (Ames, 1992; Maehr & Midgley, 1991; Meece et al., 1988). Kahraman and Sungur (2011) also found a positive relationship between mastery goal orientation and students metacognitive strategy use in a group of elementary school students. Therefore, it seems important for science teachers to support their students' mastery goal orientations. Teachers may emphasize that learning the material and improving skills are important; highlight importance of trying hard and making effort; take students' attention to monitor self-improvement and focus on increasing their understanding though instructional end evaluation activities (Ames, 1992; Pintrich & Schunk, 2002; Young, 1997). Formation of a learning environment which supports students' mastery goals thus may promote students use of active learning strategies.

Another finding of the present study was the positive relationship between self-efficacy and active learning strategies. This finding implied that students who believed that they were capable of performing well in science learning tasks utilized higher levels of active learning strategies. In other words, students who were confident about their abilities to perform well in science tasks connected new science concepts to previous experiences, found resources to improve their understanding of the science concepts, and hold discussions with the teacher and other students to clarify their understanding. Previous research also pointed that students who were highly efficacious about their abilities use more cognitive, metacognitive, and self-regulatory strategies (Kahraman & Sungur, 2011; Pajares, 2002; Pintrich & De Groot, 1990). Therefore, it is important for teachers to help their students increase self-efficacy beliefs. In order to do so, teachers may try to show students that ability can be improved through effort. Teacher may try to demonstrate the relationship between effort and achievement (Paulsen & Feldman, 2005).

The present study revealed a positive relationship between science learning value and use of active learning strategies. Students who thought that science learning is important to use it in real life, to satisfy his/her own curiosity, and to expand his/her own thinking made connections between concepts they learnt and tried to learn science concepts that they had not understood. Therefore, individuals who attached more value to learning science were more

likely to use active learning strategies. Similarly, Pintrich and De Groot (1990) studying with elementary school students also found that students with higher task value beliefs reported to use more cognitive (i.e., rehearsal, elaboration, organization) and self-regulatory (i.e., metacognitive and effort management strategies) strategies. Sungur (2007) also revealed a positive relationship between students' task value beliefs and metacognitive strategy use among high school students. Therefore, it seems important to support students for increasing their value beliefs. Teachers may hold discussions about the importance of and utility of the task in the class, model their own interest in the task, and try to give opportunities for students to activate their personal interest (Pintrich & Schunk, 2002).

In conclusion, the present study suggested that students' use of active learning strategies in science were linked to their perceptions of parental goal orientations, their reasons for engaging in the academic task (i.e., goal orientations), their beliefs about their capabilities to perform well in the task (self-efficacy), and their beliefs about the importance and utility of the task and the enjoyment due to engaging in the task (value beliefs). Therefore, some suggestions were made for parents and science teachers in order to support students' mastery goal orientations, self-efficacy, and science learning value beliefs.

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